FROGS, FLEAS, & PAINTED CUBES   Quadratic Functions

Instructional Time and Investigations	$21\frac{1}{2}$ days	• Inv. 1: Introduction to Quadratic Functions (3 Problems) • Inv. 2: Quadratic Expressions (4 Problems) • Inv. 3: Quadratic Patterns of Change (4 Problems) • Inv. 4: Frogs Meet Fleas on a Cube: More Applications of Quadratic Functions (4 Problems)
Goals	**Quadratic Functions:** Explore problem situations in which two variables are in a quadratic relationship. • A quadratic function has a unique pattern of change; as the independent variable increases by a constant amount, the second differences of the dependent variable change by a constant amount. The unique characteristics of a quadratic relationship between two quantities are recognizable from a table of ordered pairs, from a graph, and from an equation. You can translate among the various representations to determine which is most useful to solve a problem. • When one variable is dependent on the other, a function can model the data pattern. Functions allow you model real-world situations, answer questions, and make predictions about a relationship. Quadratic relationships are functions.	**Equivalence:** Develop understanding of equivalent exponential expressions. • The ability to rewrite an equation can be helpful when solving problems involving quadratic relationships and when comparing quadratic equations. You can use the Distributive Property to rewrite quadratic equations in factored form and expanded form; you can then choose the form that will help you determine characteristics of the function or solve a given problem.
Common Core Standards	**Common Core Standards for Mathematical Practice** **MP.1:** Make sense of problems and persevere in solving them. **MP.2:** Reason abstractly and quantitatively. **MP.3:** Construct viable arguments and critique the reasoning of others. **MP.4:** Model with mathematics. **MP.5:** Use appropriate tools strategically. **MP.6:** Attend to precision. **MP.7:** Look for and make use of structure. **MP.8:** Look for and express regularity in repeated reasoning.	**Common Core Content Standards** **A-SSE.A.1:** Interpret expressions that represent a quantity in terms of its context. **A-SSE.A.2:** Use the structure of an expression to identify ways to rewrite it. **F-IF.B.4:** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. **F-IF.C.7a:** Graph linear and quadratic functions and show intercepts, maxima, and minima. **F-BF.A.1:** Write a function that describes a relationship between two quantities. **Also N-Q.A.1, A-SSE.A.1a-b, A-SSE.B.3, A-CED.A.1, A-CED.A.2, A-REI.D.10, F-IF.C.7, F-IF.C.7a, F-IF.C.8, F-IF.C.8a, F-IF.C.9, F-BF.A.1, F-BF.A.1a, F-LE.A.1, F-LE.A.1a-b**

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Content Connections to Other Units

Goals of the Unit	Prior Work	Future Work
Quadratic Functions: Explore problem situations in which two variables are in a quadratic relationship.	• Analyzing linear and exponential relationships among quantitative variables (*Variables and Patterns; Moving Straight Ahead; Comparing and Scaling; Thinking With Mathematical Models; Growing, Growing, Growing*) • Comparing patterns of change in tables and graphs for linear and exponential relationships (*Moving Straight Ahead; Comparing and Scaling; Thinking With Mathematical Models; Growing, Growing, Growing*) • Understanding the significance of x- and y-intercepts of a linear function (*Moving Straight Ahead; Thinking With Mathematical Models*) • Understanding the significance of y-intercept in exponential functions (*Growing, Growing, Growing*)	• Reviewing and extending the analysis of quadratic relationships, with more emphasis on symbolic methods (*Say It With Symbols; Function Junction; High School*) • Extending the analysis of patterns of change to other polynomial and trigonometric functions (*Function Junction; high school*) • Understanding the significance of zeroes in solving equations and of maximum and minimum in applications; using symbolic methods for finding zeroes, maximum, and minimum; and applying the quadratic formula (*Function Junction; High School*)
Equivalence: Develop an understanding of equivalent quadratic expressions.	• Attaching contextual meaning to m and b in linear relationships $y = mx + b$, and to a and b in exponential relationships $y = a(b)^x$ (*Comparing and Scaling; Moving Straight Ahead; Thinking With Mathematical Models; Growing, Growing, Growing*) • Understanding the significance of scale in constructing and interpreting graphs from data (*Data About Us; Variables and Patterns; Moving Straight Ahead; Thinking With Mathematical Models; Growing, Growing, Growing*)	• Attaching contextual meaning to different forms of linear and quadratic relationships (*Say It With Symbols; It's In the System; Function Junction*) • Extending symbol sense about quadratics to include meaning and use of the quadratic formula and the formula for the vertex; attaching contextual meaning to different symbolic forms of polynomial and trigonometric functions (*Function Junction; High School*) • Exploring issues of practical and theoretical domain and range, formally treated (*Function Junction; High School*)